

# SEQUENCE LISTING

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*Ellen J. Kapinos*



## (1) GENERAL INFORMATION:

- (i) APPLICANT: Israel, David  
& Wolfman, Neil M.
- (ii) TITLE OF INVENTION: Recombinant Bone Morphogenetic Protein Heterodimers, Compositions and Methods of Use.
- (iii) NUMBER OF SEQUENCES: 30
- (iv) CORRESPONDENCE ADDRESS:
  - (A) ADDRESSEE: Legal Affairs, Genetics Institute, Inc.
  - (B) STREET: 87 CambridgePark Drive
  - (C) CITY: Cambridge
  - (D) STATE: MA
  - (E) COUNTRY: USA
  - (F) ZIP: 02140-2387
- (v) COMPUTER READABLE FORM:
  - (A) MEDIUM TYPE: Tape
  - (B) COMPUTER: IBM PC compatible
  - (C) OPERATING SYSTEM: PC-DOS/MS-DOS
  - (D) SOFTWARE: PatentIn Release #1.0, Version #1.25
- (vi) CURRENT APPLICATION DATA:
  - (A) APPLICATION NUMBER: US
  - (B) FILING DATE:
  - (C) CLASSIFICATION:
- (viii) ATTORNEY/AGENT INFORMATION:
  - (A) NAME: Kapinos, Ellen J.
  - (B) REGISTRATION NUMBER: 32,245
  - (C) REFERENCE/DOCKET NUMBER: GI-5192B
- (ix) TELECOMMUNICATION INFORMATION:
  - (A) TELEPHONE: 617-876-1170
  - (B) TELEFAX: 617-876-5851
- (2) INFORMATION FOR SEQ ID NO:1:
  - (i) SEQUENCE CHARACTERISTICS:
    - (A) LENGTH: 1607 base pairs
    - (B) TYPE: nucleic acid
    - (C) STRANDEDNESS: double
    - (D) TOPOLOGY: unknown
  - (ii) MOLECULE TYPE: DNA (genomic)
  - (ix) FEATURE:
    - (A) NAME/KEY: CDS
    - (B) LOCATION: 356..1543
  - (xi) SEQUENCE DESCRIPTION: SEQ ID NO:1:

(A) LENGTH: 396 amino acids  
(B) TYPE: amino acid  
(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:2:

Met	Val	Ala	Gly	Thr	Arg	Cys	Leu	Leu	Ala	Leu	Leu	Leu	Pro	Gln	Val	
1				5					10					15		
Leu	Leu	Gly	Gly	Ala	Ala	Gly	Leu	Val	Pro	Glu	Leu	Gly	Arg	Arg	Lys	
		20					25						30			
Phe	Ala	Ala	Ala	Ser	Ser	Gly	Arg	Pro	Ser	Ser	Gln	Pro	Ser	Asp	Glu	
		35					40					45				
Val	Leu	Ser	Glu	Phe	Glu	Leu	Arg	Leu	Leu	Ser	Met	Phe	Gly	Leu	Lys	
	50					55					60					
Gln	Arg	Pro	Thr	Pro	Ser	Arg	Asp	Ala	Val	Val	Pro	Pro	Tyr	Met	Leu	
65					70					75					80	
Asp	Leu	Tyr	Arg	Arg	His	Ser	Gly	Gln	Pro	Gly	Ser	Pro	Ala	Pro	Asp	
				85					90					95		
His	Arg	Leu	Glu	Arg	Ala	Ala	Ser	Arg	Ala	Asn	Thr	Val	Arg	Ser	Phe	
		100						105					110			
His	His	Glu	Glu	Ser	Leu	Glu	Glu	Leu	Pro	Glu	Thr	Ser	Gly	Lys	Thr	
		115					120					125				
Thr	Arg	Arg	Phe	Phe	Phe	Asn	Leu	Ser	Ser	Ile	Pro	Thr	Glu	Glu	Phe	
	130					135					140					
Ile	Thr	Ser	Ala	Glu	Leu	Gln	Val	Phe	Arg	Glu	Gln	Met	Gln	Asp	Ala	
145					150					155					160	
Leu	Gly	Asn	Asn	Ser	Ser	Phe	His	His	Arg	Ile	Asn	Ile	Tyr	Glu	Ile	
				165					170					175		
Ile	Lys	Pro	Ala	Thr	Ala	Asn	Ser	Lys	Phe	Pro	Val	Thr	Arg	Leu	Leu	
			180					185					190			
Asp	Thr	Arg	Leu	Val	Asn	Gln	Asn	Ala	Ser	Arg	Trp	Glu	Thr	Phe	Asp	
		195					200					205				
Val	Thr	Pro	Ala	Val	Met	Arg	Trp	Thr	Ala	Gln	Gly	His	Ala	Asn	His	
	210					215					220					
Gly	Phe	Val	Val	Glu	Val	Ala	His	Leu	Glu	Glu	Lys	Gln	Gly	Val	Ser	
225					230					235					240	
Lys	Arg	His	Val	Arg	Ile	Ser	Arg	Ser	Leu	His	Gln	Asp	Glu	His	Ser	
				245					250					255		
Trp	Ser	Gln	Ile	Arg	Pro	Leu	Leu	Val	Thr	Phe	Gly	His	Asp	Gly	Lys	
			260					265					270			
Gly	His	Pro	Leu	His	Lys	Arg	Glu	Lys	Arg	Gln	Ala	Lys	His	Lys	Gln	

GTCGACTCTA GAGTGTGTGT CAGCACTTGG CTGGGGACTT CTTGAACTTG CAGGGAGAAT	60
AACTTGCGCA CCCCACTTTG CGCCGGTGCC TTTGCCCCAG CGGAGCCTGC TTCGCCATCT	120
CCGAGCCCCA CCGCCCCTCC ACTCCTCGGC CTTGCCCCGAC ACTGAGACGC TGTTCCCAGC	180
GTGAAAAGAG AGACTGCGCG GCCGGCACCC GGGAGAAGGA GGAGGCAAAG AAAAGGAACG	240
GACATTCGGT CCTTGCGCCA GGTCTTTTGA CCAGAGTTTT TCCATGTGGA CGCTCTTTCA	300
ATGGACGTGT CCCC GCGTGC TTCTTAGACG GACTGCGGTC TCCTAAAGGT CGACC ATG	358
Met	
1	
GTG GCC GGG ACC CGC TGT CTT CTA GCG TTG CTG CTT CCC CAG GTC CTC	406
Val Ala Gly Thr Arg Cys Leu Leu Ala Leu Leu Leu Pro Gln Val Leu	
5 10 15	
CTG GGC GGC GCG GCT GGC CTC GTT CCG GAG CTG GGC CGC AGG AAG TTC	454
Leu Gly Gly Ala Ala Gly Leu Val Pro Glu Leu Gly Arg Arg Lys Phe	
20 25 30	
GCG GCG GCG TCG TCG GGC CGC CCC TCA TCC CAG CCC TCT GAC GAG GTC	502
Ala Ala Ala Ser Ser Gly Arg Pro Ser Ser Gln Pro Ser Asp Glu Val	
35 40 45	
CTG AGC GAG TTC GAG TTG CGG CTG CTC AGC ATG TTC GGC CTG AAA CAG	550
Leu Ser Glu Phe Glu Leu Arg Leu Leu Ser Met Phe Gly Leu Lys Gln	
50 55 60 65	
AGA CCC ACC CCC AGC AGG GAC GCC GTG GTG CCC CCC TAC ATG CTA GAC	598
Arg Pro Thr Pro Ser Arg Asp Ala Val Val Pro Pro Tyr Met Leu Asp	
70 75 80	
CTG TAT CGC AGG CAC TCA GGT CAG CCG GGC TCA CCC GCC CCA GAC CAC	646
Leu Tyr Arg Arg His Ser Gly Gln Pro Gly Ser Pro Ala Pro Asp His	
85 90 95	
CGG TTG GAG AGG GCA GCC AGC CGA GCC AAC ACT GTG CGC AGC TTC CAC	694
Arg Leu Glu Arg Ala Ala Ser Arg Ala Asn Thr Val Arg Ser Phe His	
100 105 110	
CAT GAA GAA TCT TTG GAA GAA CTA CCA GAA ACG AGT GGG AAA ACA ACC	742
His Glu Glu Ser Leu Glu Glu Leu Pro Glu Thr Ser Gly Lys Thr Thr	
115 120 125	
CGG AGA TTC TTC TTT AAT TTA AGT TCT ATC CCC ACG GAG GAG TTT ATC	790
Arg Arg Phe Phe Phe Asn Leu Ser Ser Ile Pro Thr Glu Glu Phe Ile	
130 135 140 145	
ACC TCA GCA GAG CTT CAG GTT TTC CGA GAA CAG ATG CAA GAT GCT TTA	838
Thr Ser Ala Glu Leu Gln Val Phe Arg Glu Gln Met Gln Asp Ala Leu	
150 155 160	
GGA AAC AAT AGC AGT TTC CAT CAC CGA ATT AAT ATT TAT GAA ATC ATA	886
Gly Asn Asn Ser Ser Phe His His Arg Ile Asn Ile Tyr Glu Ile Ile	
165 170 175	
AAA CCT GCA ACA GCC AAC TCG AAA TTC CCC GTG ACC AGA CTT TTG GAC	934
Lys Pro Ala Thr Ala Asn Ser Lys Phe Pro Val Thr Arg Leu Leu Asp	

180	185	190	
ACC AGG TTG GTG AAT CAG AAT GCA AGC AGG TGG GAA ACT TTT GAT GTC			982
Thr Arg Leu Val Asn Gln Asn Ala Ser Arg Trp Glu Thr Phe Asp Val			
195	200	205	
ACC CCC GCT GTG ATG CGG TGG ACT GCA CAG GGA CAC GCC AAC CAT GGA			1030
Thr Pro Ala Val Met Arg Trp Thr Ala Gln Gly His Ala Asn His Gly			
210	215	220	225
TTC GTG GTG GAA GTG GCC CAC TTG GAG GAG AAA CAA GGT GTC TCC AAG			1078
Phe Val Val Glu Val Ala His Leu Glu Glu Lys Gln Gly Val Ser Lys			
	230	235	240
AGA CAT GTT AGG ATA AGC AGG TCT TTG CAC CAA GAT GAA CAC AGC TGG			1126
Arg His Val Arg Ile Ser Arg Ser Leu His Gln Asp Glu His Ser Trp			
	245	250	255
TCA CAG ATA AGG CCA TTG CTA GTA ACT TTT GGC CAT GAT GGA AAA GGG			1174
Ser Gln Ile Arg Pro Leu Leu Val Thr Phe Gly His Asp Gly Lys Gly			
	260	265	270
CAT CCT CTC CAC AAA AGA GAA AAA CGT CAA GCC AAA CAC AAA CAG CGG			1222
His Pro Leu His Lys Arg Glu Lys Arg Gln Ala Lys His Lys Gln Arg			
	275	280	285
AAA CGC CTT AAG TCC AGC TGT AAG AGA CAC CCT TTG TAC GTG GAC TTC			1270
Lys Arg Leu Lys Ser Ser Cys Lys Arg His Pro Leu Tyr Val Asp Phe			
	295	300	305
AGT GAC GTG GGG TGG AAT GAC TGG ATT GTG GCT CCC CCG GGG TAT CAC			1318
Ser Asp Val Gly Trp Asn Asp Trp Ile Val Ala Pro Pro Gly Tyr His			
	310	315	320
GCC TTT TAC TGC CAC GGA GAA TGC CCT TTT CCT CTG GCT GAT CAT CTG			1366
Ala Phe Tyr Cys His Gly Glu Cys Pro Phe Pro Leu Ala Asp His Leu			
	325	330	335
AAC TCC ACT AAT CAT GCC ATT GTT CAG ACG TTG GTC AAC TCT GTT AAC			1414
Asn Ser Thr Asn His Ala Ile Val Gln Thr Leu Val Asn Ser Val Asn			
	340	345	350
TCT AAG ATT CCT AAG GCA TGC TGT GTC CCG ACA GAA CTC AGT GCT ATC			1462
Ser Lys Ile Pro Lys Ala Cys Cys Val Pro Thr Glu Leu Ser Ala Ile			
	355	360	365
TCG ATG CTG TAC CTT GAC GAG AAT GAA AAG GTT GTA TTA AAG AAC TAT			1510
Ser Met Leu Tyr Leu Asp Glu Asn Glu Lys Val Val Leu Lys Asn Tyr			
	375	380	385
CAG GAC ATG GTT GTG GAG GGT TGT GGG TGT CGC TAGTACAGCA AAATTAAATA			1563
Gln Asp Met Val Val Glu Gly Cys Gly Cys Arg			
	390	395	
CATAAATATA TATATATATA TATATTTTAG AAAAAAGAAA AAAA			1607

(2) INFORMATION FOR SEQ ID NO:2:

(i) SEQUENCE CHARACTERISTICS:

275					280					285					
Arg	Lys	Arg	Leu	Lys	Ser	Ser	Cys	Lys	Arg	His	Pro	Leu	Tyr	Val	Asp
290						295					300				
Phe	Ser	Asp	Val	Gly	Trp	Asn	Asp	Trp	Ile	Val	Ala	Pro	Pro	Gly	Tyr
305					310					315					320
His	Ala	Phe	Tyr	Cys	His	Gly	Glu	Cys	Pro	Phe	Pro	Leu	Ala	Asp	His
				325					330					335	
Leu	Asn	Ser	Thr	Asn	His	Ala	Ile	Val	Gln	Thr	Leu	Val	Asn	Ser	Val
			340					345					350		
Asn	Ser	Lys	Ile	Pro	Lys	Ala	Cys	Cys	Val	Pro	Thr	Glu	Leu	Ser	Ala
		355					360					365			
Ile	Ser	Met	Leu	Tyr	Leu	Asp	Glu	Asn	Glu	Lys	Val	Val	Leu	Lys	Asn
370					375					380					
Tyr	Gln	Asp	Met	Val	Val	Glu	Gly	Cys	Gly	Cys	Arg				
385					390					395					

(2) INFORMATION FOR SEQ ID NO:3:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 1954 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: double  
 (D) TOPOLOGY: unknown

(ii) MOLECULE TYPE: DNA (genomic)

- (ix) FEATURE:  
 (A) NAME/KEY: CDS  
 (B) LOCATION: 403..1626

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:3:

CTCTAGAGGG CAGAGGAGGA GGGAGGGAGG GAAGGAGCGC GGAGCCCGGC CCGGAAGCTA	60
GGTGAGTGTG GCATCCGAGC TGAGGGACGC GAGCCTGAGA CGCCGCTGCT GCTCCGGCTG	120
AGTATCTAGC TTGTCTCCCC GATGGGATTC CCGTCCAAGC TATCTCGAGC CTGCAGCGCC	180
ACAGTCCCCG GCCCTCGCCC AGGTTCACCTG CAACCGTTCA GAGGTCCCCA GGAGCTGCTG	240
CTGGCGAGCC CGCTACTGCA GGGACCTATG GAGCCATTCC GTAGTGCCAT CCCGAGCAAC	300
GCACTGCTGC AGCTTCCCTG AGCCTTTCCA GCAAGTTTGT TCAAGATTGG CTGTCAAGAA	360
TCATGGACTG TTATTATATG CCTTGTTTTT TGTCAAGACA CC ATG ATT CCT GGT	414
Met Ile Pro Gly	
1	
AAC CGA ATG CTG ATG GTC GTT TTA TTA TGC CAA GTC CTG CTA GGA GGC	462
Asn Arg Met Leu Met Val Val Leu Leu Cys Gln Val Leu Leu Gly Gly	
5 10 15 20	

GCG AGC CAT GCT AGT TTG ATA CCT GAG ACG GGG AAG AAA AAA GTC GCC	510
Ala Ser His Ala Ser Leu Ile Pro Glu Thr Gly Lys Lys Lys Val Ala	
25 30 35	
GAG ATT CAG GGC CAC GCG GGA GGA CGC CGC TCA GGG CAG AGC CAT GAG	558
Glu Ile Gln Gly His Ala Gly Gly Arg Arg Ser Gly Gln Ser His Glu	
40 45 50	
CTC CTG CGG GAC TTC GAG GCG ACA CTT CTG CAG ATG TTT GGG CTG CGC	606
Leu Leu Arg Asp Phe Glu Ala Thr Leu Leu Gln Met Phe Gly Leu Arg	
55 60 65	
CGC CGC CCG CAG CCT AGC AAG AGT GCC GTC ATT CCG GAC TAC ATG CGG	654
Arg Arg Pro Gln Pro Ser Lys Ser Ala Val Ile Pro Asp Tyr Met Arg	
70 75 80	
GAT CTT TAC CGG CTT CAG TCT GGG GAG GAG GAG GAA GAG CAG ATC CAC	702
Asp Leu Tyr Arg Leu Gln Ser Gly Glu Glu Glu Glu Glu Gln Ile His	
85 90 95 100	
AGC ACT GGT CTT GAG TAT CCT GAG CGC CCG GCC AGC CGG GCC AAC ACC	750
Ser Thr Gly Leu Glu Tyr Pro Glu Arg Pro Ala Ser Arg Ala Asn Thr	
105 110 115	
GTG AGG AGC TTC CAC CAC GAA GAA CAT CTG GAG AAC ATC CCA GGG ACC	798
Val Arg Ser Phe His His Glu Glu His Leu Glu Asn Ile Pro Gly Thr	
120 125 130	
AGT GAA AAC TCT GCT TTT CGT TTC CTC TTT AAC CTC AGC AGC ATC CCT	846
Ser Glu Asn Ser Ala Phe Arg Phe Leu Phe Asn Leu Ser Ser Ile Pro	
135 140 145	
GAG AAC GAG GTG ATC TCC TCT GCA GAG CTT CGG CTC TTC CGG GAG CAG	894
Glu Asn Glu Val Ile Ser Ser Ala Glu Leu Arg Leu Phe Arg Glu Gln	
150 155 160	
GTG GAC CAG GGC CCT GAT TGG GAA AGG GGC TTC CAC CGT ATA AAC ATT	942
Val Asp Gln Gly Pro Asp Trp Glu Arg Gly Phe His Arg Ile Asn Ile	
165 170 175 180	
TAT GAG GTT ATG AAG CCC CCA GCA GAA GTG GTG CCT GGG CAC CTC ATC	990
Tyr Glu Val Met Lys Pro Pro Ala Glu Val Val Pro Gly His Leu Ile	
185 190 195	
ACA CGA CTA CTG GAC ACG AGA CTG GTC CAC CAC AAT GTG ACA CGG TGG	1038
Thr Arg Leu Leu Asp Thr Arg Leu Val His His Asn Val Thr Arg Trp	
200 205 210	
GAA ACT TTT GAT GTG AGC CCT GCG GTC CTT CGC TGG ACC CGG GAG AAG	1086
Glu Thr Phe Asp Val Ser Pro Ala Val Leu Arg Trp Thr Arg Glu Lys	
215 220 225	
CAG CCA AAC TAT GGG CTA GCC ATT GAG GTG ACT CAC CTC CAT CAG ACT	1134
Gln Pro Asn Tyr Gly Leu Ala Ile Glu Val Thr His Leu His Gln Thr	
230 235 240	
CGG ACC CAC CAG GGC CAG CAT GTC AGG ATT AGC CGA TCG TTA CCT CAA	1182
Arg Thr His Gln Gly Gln His Val Arg Ile Ser Arg Ser Leu Pro Gln	
245 250 255 260	

GGG AGT GGG AAT TGG GCC CAG CTC CGG CCC CTC CTG GTC ACC TTT GGC Gly Ser Gly Asn Trp Ala Gln Leu Arg Pro Leu Leu Val Thr Phe Gly 265 270 275	1230
CAT GAT GGC CGG GGC CAT GCC TTG ACC CGA CGC CGG AGG GCC AAG CGT His Asp Gly Arg Gly His Ala Leu Thr Arg Arg Arg Arg Ala Lys Arg 280 285 290	1278
AGC CCT AAG CAT CAC TCA CAG CGG GCC AGG AAG AAG AAT AAG AAC TGC Ser Pro Lys His His Ser Gln Arg Ala Arg Lys Lys Asn Lys Asn Cys 295 300 305	1326
CGG CGC CAC TCG CTC TAT GTG GAC TTC AGC GAT GTG GGC TGG AAT GAC Arg Arg His Ser Leu Tyr Val Asp Phe Ser Asp Val Gly Trp Asn Asp 310 315 320	1374
TGG ATT GTG GCC CCA CCA GGC TAC CAG GCC TTC TAC TGC CAT GGG GAC Trp Ile Val Ala Pro Pro Gly Tyr Gln Ala Phe Tyr Cys His Gly Asp 325 330 335 340	1422
TGC CCC TTT CCA CTG GCT GAC CAC CTC AAC TCA ACC AAC CAT GCC ATT Cys Pro Phe Pro Leu Ala Asp His Leu Asn Ser Thr Asn His Ala Ile 345 350 355	1470
GTG CAG ACC CTG GTC AAT TCT GTC AAT TCC AGT ATC CCC AAA GCC TGT Val Gln Thr Leu Val Asn Ser Val Asn Ser Ser Ile Pro Lys Ala Cys 360 365 370	1518
TGT GTG CCC ACT GAA CTG AGT GCC ATC TCC ATG CTG TAC CTG GAT GAG Cys Val Pro Thr Glu Leu Ser Ala Ile Ser Met Leu Tyr Leu Asp Glu 375 380 385	1566
TAT GAT AAG GTG GTA CTG AAA AAT TAT CAG GAG ATG GTA GTA GAG GGA Tyr Asp Lys Val Val Leu Lys Asn Tyr Gln Glu Met Val Val Glu Gly 390 395 400	1614
TGT GGG TGC CGC TGAGATCAGG CAGTCCTTGA GGATAGACAG ATATACACAC Cys Gly Cys Arg 405	1666
CACACACACA CACCACATAC ACCACACACA CACGTTCCCA TCCACTCACC CACACACTAC	1726
ACAGACTGCT TCCTTATAGC TGGACTTTTA TTAAAAAAA AAAAAAAAAA AATGGAAAAA	1786
ATCCCTAAAC ATTCACCTTG ACCTTATTTA TGACTTTACG TGCAAAATGTT TTGACCATAT	1846
TGATCATATA TTTTGACAAA ATATATTTAT AACTACGTAT TAAAAGAAAA AAATAAAATG	1906
AGTCATTATT TTAAAAAAA AAAAAAACT CTAGAGTCGA CGGAATTC	1954

(2) INFORMATION FOR SEQ ID NO:4:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 408 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:4:

Met Ile Pro Gly Asn Arg Met Leu Met Val Val Leu Leu Cys Gln Val  
1 5 10 15  
Leu Leu Gly Gly Ala Ser His Ala Ser Leu Ile Pro Glu Thr Gly Lys  
20 25 30  
Lys Lys Val Ala Glu Ile Gln Gly His Ala Gly Gly Arg Arg Ser Gly  
35 40 45  
Gln Ser His Glu Leu Leu Arg Asp Phe Glu Ala Thr Leu Leu Gln Met  
50 55 60  
Phe Gly Leu Arg Arg Arg Pro Gln Pro Ser Lys Ser Ala Val Ile Pro  
65 70 75 80  
Asp Tyr Met Arg Asp Leu Tyr Arg Leu Gln Ser Gly Glu Glu Glu Glu  
85 90 95  
Glu Gln Ile His Ser Thr Gly Leu Glu Tyr Pro Glu Arg Pro Ala Ser  
100 105 110  
Arg Ala Asn Thr Val Arg Ser Phe His His Glu Glu His Leu Glu Asn  
115 120 125  
Ile Pro Gly Thr Ser Glu Asn Ser Ala Phe Arg Phe Leu Phe Asn Leu  
130 135 140  
Ser Ser Ile Pro Glu Asn Glu Val Ile Ser Ser Ala Glu Leu Arg Leu  
145 150 155 160  
Phe Arg Glu Gln Val Asp Gln Gly Pro Asp Trp Glu Arg Gly Phe His  
165 170 175  
Arg Ile Asn Ile Tyr Glu Val Met Lys Pro Pro Ala Glu Val Val Pro  
180 185 190  
Gly His Leu Ile Thr Arg Leu Leu Asp Thr Arg Leu Val His His Asn  
195 200 205  
Val Thr Arg Trp Glu Thr Phe Asp Val Ser Pro Ala Val Leu Arg Trp  
210 215 220  
Thr Arg Glu Lys Gln Pro Asn Tyr Gly Leu Ala Ile Glu Val Thr His  
225 230 235 240  
Leu His Gln Thr Arg Thr His Gln Gly Gln His Val Arg Ile Ser Arg  
245 250 255  
Ser Leu Pro Gln Gly Ser Gly Asn Trp Ala Gln Leu Arg Pro Leu Leu  
260 265 270  
Val Thr Phe Gly His Asp Gly Arg Gly His Ala Leu Thr Arg Arg Arg  
275 280 285  
Arg Ala Lys Arg Ser Pro Lys His His Ser Gln Arg Ala Arg Lys Lys  
290 295 300



Asn Lys Asn Cys Arg Arg His Ser Leu Tyr Val Asp Phe Ser Asp Val  
 305 310 315 320  
 Gly Trp Asn Asp Trp Ile Val Ala Pro Pro Gly Tyr Gln Ala Phe Tyr  
 325 330 335  
 Cys His Gly Asp Cys Pro Phe Pro Leu Ala Asp His Leu Asn Ser Thr  
 340 345 350  
 Asn His Ala Ile Val Gln Thr Leu Val Asn Ser Val Asn Ser Ser Ile  
 355 360 365  
 Pro Lys Ala Cys Cys Val Pro Thr Glu Leu Ser Ala Ile Ser Met Leu  
 370 375 380  
 Tyr Leu Asp Glu Tyr Asp Lys Val Val Leu Lys Asn Tyr Gln Glu Met  
 385 390 395 400  
 Val Val Glu Gly Cys Gly Cys Arg  
 405

(2) INFORMATION FOR SEQ ID NO:5:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 1448 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: unknown

(ii) MOLECULE TYPE: DNA (genomic)

- (ix) FEATURE:
- (A) NAME/KEY: CDS
  - (B) LOCATION: 97..1389

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:5:

GTGACCGAGC GGC GCGGACG GCCGCCTGCC CCCTCTGCCA CCTGGGGCGG TGCGGGCCCCG	60
GAGCCCGGAG CCCGGGTAGC GCGTAGAGCC GGCGCG ATG CAC GTG CGC TCA CTG	114
Met His Val Arg Ser Leu	
1 5	
CGA GCT GCG GCG CCG CAC AGC TTC GTG GCG CTC TGG GCA CCC CTG TTC	162
Arg Ala Ala Ala Pro His Ser Phe Val Ala Leu Trp Ala Pro Leu Phe	
10 15 20	
CTG CTG CGC TCC GCC CTG GCC GAC TTC AGC CTG GAC AAC GAG GTG CAC	210
Leu Leu Arg Ser Ala Leu Ala Asp Phe Ser Leu Asp Asn Glu Val His	
25 30 35	
TCG AGC TTC ATC CAC CGG CGC CTC CGC AGC CAG GAG CGG CGG GAG ATG	258
Ser Ser Phe Ile His Arg Arg Leu Arg Ser Gln Glu Arg Arg Glu Met	
40 45 50	
CAG CGC GAG ATC CTC TCC ATT TTG GGC TTG CCC CAC CGC CCG CGC CCG	306
Gln Arg Glu Ile Leu Ser Ile Leu Gly Leu Pro His Arg Pro Arg Pro	
55 60 65 70	

CAC	CTC	CAG	GGC	AAG	CAC	AAC	TCG	GCA	CCC	ATG	TTC	ATG	CTG	GAC	CTG	354
His	Leu	Gln	Gly	Lys	His	Asn	Ser	Ala	Pro	Met	Phe	Met	Leu	Asp	Leu	
				75					80					85		
TAC	AAC	GCC	ATG	GCG	GTG	GAG	GAG	GGC	GGC	GGG	CCC	GGC	GGC	CAG	GGC	402
Tyr	Asn	Ala	Met	Ala	Val	Glu	Glu	Gly	Gly	Gly	Pro	Gly	Gly	Gln	Gly	
			90					95					100			
TTC	TCC	TAC	CCC	TAC	AAG	GCC	GTC	TTC	AGT	ACC	CAG	GGC	CCC	CCT	CTG	450
Phe	Ser	Tyr	Pro	Tyr	Lys	Ala	Val	Phe	Ser	Thr	Gln	Gly	Pro	Pro	Leu	
		105					110					115				
GCC	AGC	CTG	CAA	GAT	AGC	CAT	TTC	CTC	ACC	GAC	GCC	GAC	ATG	GTC	ATG	498
Ala	Ser	Leu	Gln	Asp	Ser	His	Phe	Leu	Thr	Asp	Ala	Asp	Met	Val	Met	
	120					125					130					
AGC	TTC	GTC	AAC	CTC	GTG	GAA	CAT	GAC	AAG	GAA	TTC	TTC	CAC	CCA	CGC	546
Ser	Phe	Val	Asn	Leu	Val	Glu	His	Asp	Lys	Glu	Phe	Phe	His	Pro	Arg	
135					140				145						150	
TAC	CAC	CAT	CGA	GAG	TTC	CGG	TTT	GAT	CTT	TCC	AAG	ATC	CCA	GAA	GGG	594
Tyr	His	His	Arg	Glu	Phe	Arg	Phe	Asp	Leu	Ser	Lys	Ile	Pro	Glu	Gly	
				155					160					165		
GAA	GCT	GTC	ACG	GCA	GCC	GAA	TTC	CGG	ATC	TAC	AAG	GAC	TAC	ATC	CGG	642
Glu	Ala	Val	Thr	Ala	Ala	Glu	Phe	Arg	Ile	Tyr	Lys	Asp	Tyr	Ile	Arg	
			170					175					180			
GAA	CGC	TTC	GAC	AAT	GAG	ACG	TTC	CGG	ATC	AGC	GTT	TAT	CAG	GTG	CTC	690
Glu	Arg	Phe	Asp	Asn	Glu	Thr	Phe	Arg	Ile	Ser	Val	Tyr	Gln	Val	Leu	
	185						190					195				
CAG	GAG	CAC	TTG	GGC	AGG	GAA	TCG	GAT	CTC	TTC	CTG	CTC	GAC	AGC	CGT	738
Gln	Glu	His	Leu	Gly	Arg	Glu	Ser	Asp	Leu	Phe	Leu	Leu	Asp	Ser	Arg	
	200					205					210					
ACC	CTC	TGG	GCC	TCG	GAG	GAG	GGC	TGG	CTG	GTG	TTT	GAC	ATC	ACA	GCC	786
Thr	Leu	Trp	Ala	Ser	Glu	Glu	Gly	Trp	Leu	Val	Phe	Asp	Ile	Thr	Ala	
215					220				225						230	
ACC	AGC	AAC	CAC	TGG	GTG	GTC	AAT	CCG	CGG	CAC	AAC	CTG	GGC	CTG	CAG	834
Thr	Ser	Asn	His	Trp	Val	Val	Asn	Pro	Arg	His	Asn	Leu	Gly	Leu	Gln	
				235				240						245		
CTC	TCG	GTG	GAG	ACG	CTG	GAT	GGG	CAG	AGC	ATC	AAC	CCC	AAG	TTG	GCG	882
Leu	Ser	Val	Glu	Thr	Leu	Asp	Gly	Gln	Ser	Ile	Asn	Pro	Lys	Leu	Ala	
			250					255					260			
GGC	CTG	ATT	GGG	CGG	CAC	GGG	CCC	CAG	AAC	AAG	CAG	CCC	TTC	ATG	GTG	930
Gly	Leu	Ile	Gly	Arg	His	Gly	Pro	Gln	Asn	Lys	Gln	Pro	Phe	Met	Val	
		265					270					275				
GCT	TTC	TTC	AAG	GCC	ACG	GAG	GTC	CAC	TTC	CGC	AGC	ATC	CGG	TCC	ACG	978
Ala	Phe	Phe	Lys	Ala	Thr	Glu	Val	His	Phe	Arg	Ser	Ile	Arg	Ser	Thr	
	280					285					290					
GGG	AGC	AAA	CAG	CGC	AGC	CAG	AAC	CGC	TCC	AAG	ACG	CCC	AAG	AAC	CAG	1026
Gly	Ser	Lys	Gln	Arg	Ser	Gln	Asn	Arg	Ser	Lys	Thr	Pro	Lys	Asn	Gln	
295					300					305					310	

GAA GCC CTG CGG ATG GCC AAC GTG GCA GAG AAC AGC AGC AGC GAC CAG Glu Ala Leu Arg Met Ala Asn Val Ala Glu Asn Ser Ser Ser Asp Gln 315 320 325	1074
AGG CAG GCC TGT AAG AAG CAC GAG CTG TAT GTC AGC TTC CGA GAC CTG Arg Gln Ala Cys Lys Lys His Glu Leu Tyr Val Ser Phe Arg Asp Leu 330 335 340	1122
GGC TGG CAG GAC TGG ATC ATC GCG CCT GAA GGC TAC GCC GCC TAC TAC Gly Trp Gln Asp Trp Ile Ile Ala Pro Glu Gly Tyr Ala Ala Tyr Tyr 345 350 355	1170
TGT GAG GGG GAG TGT GCC TTC CCT CTG AAC TCC TAC ATG AAC GCC ACC Cys Glu Gly Glu Cys Ala Phe Pro Leu Asn Ser Tyr Met Asn Ala Thr 360 365 370	1218
AAC CAC GCC ATC GTG CAG ACG CTG GTC CAC TTC ATC AAC CCG GAA ACG Asn His Ala Ile Val Gln Thr Leu Val His Phe Ile Asn Pro Glu Thr 375 380 385 390	1266
GTG CCC AAG CCC TGC TGT GCG CCC ACG CAG CTC AAT GCC ATC TCC GTC Val Pro Lys Pro Cys Cys Ala Pro Thr Gln Leu Asn Ala Ile Ser Val 395 400 405	1314
CTC TAC TTC GAT GAC AGC TCC AAC GTC ATC CTG AAG AAA TAC AGA AAC Leu Tyr Phe Asp Asp Ser Ser Asn Val Ile Leu Lys Lys Tyr Arg Asn 410 415 420	1362
ATG GTG GTC CGG GCC TGT GGC TGC CAC TAGCTCCTCC GAGAATTCAG Met Val Val Arg Ala Cys Gly Cys His 425 430	1409
ACCCTTTGGG GCCAAGTTTT TCTGGATCCT CCATTGCTC	1448

(2) INFORMATION FOR SEQ ID NO:6:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 431 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:6:

Met His Val Arg Ser Leu Arg Ala Ala Ala Pro His Ser Phe Val Ala 1 5 10 15
Leu Trp Ala Pro Leu Phe Leu Leu Arg Ser Ala Leu Ala Asp Phe Ser 20 25 30
Leu Asp Asn Glu Val His Ser Ser Phe Ile His Arg Arg Leu Arg Ser 35 40 45
Gln Glu Arg Arg Glu Met Gln Arg Glu Ile Leu Ser Ile Leu Gly Leu 50 55 60
Pro His Arg Pro Arg Pro His Leu Gln Gly Lys His Asn Ser Ala Pro

65	70	75	80
Met Phe Met Leu Asp 85	Leu Tyr Asn Ala Met 90	Ala Val Glu Glu Gly 95	Gly
Gly Pro Gly Gly Gln Gly Phe Ser Tyr Pro Tyr Lys Ala Val Phe Ser 100	105	110	
Thr Gln Gly Pro Pro Leu Ala Ser Leu Gln Asp Ser His Phe Leu Thr 115	120	125	
Asp Ala Asp Met Val Met Ser Phe Val Asn Leu Val Glu His Asp Lys 130	135	140	
Glu Phe Phe His Pro Arg Tyr His His Arg Glu Phe Arg Phe Asp Leu 145	150	155	160
Ser Lys Ile Pro Glu Gly Glu Ala Val Thr Ala Ala Glu Phe Arg Ile 165	170	175	
Tyr Lys Asp Tyr Ile Arg Glu Arg Phe Asp Asn Glu Thr Phe Arg Ile 180	185	190	
Ser Val Tyr Gln Val Leu Gln Glu His Leu Gly Arg Glu Ser Asp Leu 195	200	205	
Phe Leu Leu Asp Ser Arg Thr Leu Trp Ala Ser Glu Glu Gly Trp Leu 210	215	220	
Val Phe Asp Ile Thr Ala Thr Ser Asn His Trp Val Val Asn Pro Arg 225	230	235	240
His Asn Leu Gly Leu Gln Leu Ser Val Glu Thr Leu Asp Gly Gln Ser 245	250	255	
Ile Asn Pro Lys Leu Ala Gly Leu Ile Gly Arg His Gly Pro Gln Asn 260	265	270	
Lys Gln Pro Phe Met Val Ala Phe Phe Lys Ala Thr Glu Val His Phe 275	280	285	
Arg Ser Ile Arg Ser Thr Gly Ser Lys Gln Arg Ser Gln Asn Arg Ser 290	295	300	
Lys Thr Pro Lys Asn Gln Glu Ala Leu Arg Met Ala Asn Val Ala Glu 305	310	315	320
Asn Ser Ser Ser Asp Gln Arg Gln Ala Cys Lys Lys His Glu Leu Tyr 325	330	335	
Val Ser Phe Arg Asp Leu Gly Trp Gln Asp Trp Ile Ile Ala Pro Glu 340	345	350	
Gly Tyr Ala Ala Tyr Tyr Cys Glu Gly Glu Cys Ala Phe Pro Leu Asn 355	360	365	
Ser Tyr Met Asn Ala Thr Asn His Ala Ile Val Gln Thr Leu Val His 370	375	380	
Phe Ile Asn Pro Glu Thr Val Pro Lys Pro Cys Cys Ala Pro Thr Gln			

385		390		395		400									
Leu	Asn	Ala	Ile	Ser	Val	Leu	Tyr	Phe	Asp	Asp	Ser	Ser	Asn	Val	Ile
				405					410					415	
Leu	Lys	Lys	Tyr	Arg	Asn	Met	Val	Val	Arg	Ala	Cys	Gly	Cys	His	
			420					425					430		

(2) INFORMATION FOR SEQ ID NO:7:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 2923 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: circular
- (ii) MOLECULE TYPE: cDNA to mRNA
- (iii) HYPOTHETICAL: NO
- (vi) ORIGINAL SOURCE:
  - (A) ORGANISM: Homo sapiens
  - (F) TISSUE TYPE: Human placenta
- (vii) IMMEDIATE SOURCE:
  - (A) LIBRARY: Stratagene catalog #936203 Human placenta cDNA library
  - (B) CLONE: BMP6C35
- (viii) POSITION IN GENOME:
  - (C) UNITS: bp
- (ix) FEATURE:
  - (A) NAME/KEY: CDS
  - (B) LOCATION: 160..1701
- (ix) FEATURE:
  - (A) NAME/KEY: mat\_peptide
  - (B) LOCATION: 1282..1698
- (ix) FEATURE:
  - (A) NAME/KEY: mRNA
  - (B) LOCATION: 1..2923

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:7:

CGACCATGAG AGATAAGGAC TGAGGGCCAG GAAGGGAAG CGAGCCCGCC GAGAGGTGGC	60
GGGGACTGCT CACGCCAAGG GCCACAGCGG CCGCGCTCCG GCCTCGCTCC GCCGCTCCAC	120
GCCTCGCGGG ATCCGCGGGG GCAGCCCGGC CGGGCGGGG ATG CCG GGG CTG GGG	174
Met Pro Gly Leu Gly	
-374 -370	
CGG AGG GCG CAG TGG CTG TGC TGG TGG TGG GGG CTG CTG TGC AGC TGC	222
Arg Arg Ala Gln Trp Leu Cys Trp Trp Trp Gly Leu Leu Cys Ser Cys	
-365 -360 -355	
TGC GGG CCC CCG CCG CTG CGG CCG CCC TTG CCC GCT GCC GCG GCC GCC	270

Cys Gly Pro Pro Pro Leu Arg Pro Pro Leu Pro Ala Ala Ala Ala Ala	
-350 -345 -340	
GCC GCC GGG GGG CAG CTG CTG GGG GAC GGC GGG AGC CCC GGC CGC ACG	318
Ala Ala Gly Gly Gln Leu Leu Gly Asp Gly Gly Ser Pro Gly Arg Thr	
-335 -330 -325	
GAG CAG CCG CCG CCG TCG CCG CAG TCC TCC TCG GGC TTC CTG TAC CGG	366
Glu Gln Pro Pro Pro Ser Pro Gln Ser Ser Ser Gly Phe Leu Tyr Arg	
-320 -315 -310	
CGG CTC AAG ACG CAG GAG AAG CGG GAG ATG CAG AAG GAG ATC TTG TCG	414
Arg Leu Lys Thr Gln Glu Lys Arg Glu Met Gln Lys Glu Ile Leu Ser	
-305 -300 -295 -290	
GTG CTG GGG CTC CCG CAC CGG CCC CGG CCC CTG CAC GGC CTC CAA CAG	462
Val Leu Gly Leu Pro His Arg Pro Arg Pro Leu His Gly Leu Gln Gln	
-285 -280 -275	
CCG CAG CCC CCG GCG CTC CGG CAG CAG GAG GAG CAG CAG CAG CAG CAG	510
Pro Gln Pro Pro Ala Leu Arg Gln Gln Glu Glu Gln Gln Gln Gln Gln	
-270 -265 -260	
CAG CTG CCT CGC GGA GAG CCC CCT CCC GGG CGA CTG AAG TCC GCG CCC	558
Gln Leu Pro Arg Gly Glu Pro Pro Pro Gly Arg Leu Lys Ser Ala Pro	
-255 -250 -245	
CTC TTC ATG CTG GAT CTG TAC AAC GCC CTG TCC GCC GAC AAC GAC GAG	606
Leu Phe Met Leu Asp Leu Tyr Asn Ala Leu Ser Ala Asp Asn Asp Glu	
-240 -235 -230	
GAC GGG GCG TCG GAG GGG GAG AGG CAG CAG TCC TGG CCC CAC GAA GCA	654
Asp Gly Ala Ser Glu Gly Glu Arg Gln Gln Ser Trp Pro His Glu Ala	
-225 -220 -215 -210	
GCC AGC TCG TCC CAG CGT CGG CAG CCG CCC CCG GGC GCC GCG CAC CCG	702
Ala Ser Ser Ser Gln Arg Arg Gln Pro Pro Pro Gly Ala Ala His Pro	
-205 -200 -195	
CTC AAC CGC AAG AGC CTT CTG GCC CCC GGA TCT GGC AGC GGC GGC GCG	750
Leu Asn Arg Lys Ser Leu Leu Ala Pro Gly Ser Gly Ser Gly Gly Ala	
-190 -185 -180	
TCC CCA CTG ACC AGC GCG CAG GAC AGC GCC TTC CTC AAC GAC GCG GAC	798
Ser Pro Leu Thr Ser Ala Gln Asp Ser Ala Phe Leu Asn Asp Ala Asp	
-175 -170 -165	
ATG GTC ATG AGC TTT GTG AAC CTG GTG GAG TAC GAC AAG GAG TTC TCC	846
Met Val Met Ser Phe Val Asn Leu Val Glu Tyr Asp Lys Glu Phe Ser	
-160 -155 -150	
CCT CGT CAG CGA CAC CAC AAA GAG TTC AAG TTC AAC TTA TCC CAG ATT	894
Pro Arg Gln Arg His His Lys Glu Phe Lys Phe Asn Leu Ser Gln Ile	
-145 -140 -135 -130	
CCT GAG GGT GAG GTG GTG ACG GCT GCA GAA TTC CGC ATC TAC AAG GAC	942
Pro Glu Gly Glu Val Val Thr Ala Ala Glu Phe Arg Ile Tyr Lys Asp	
-125 -120 -115	
TGT GTT ATG GGG AGT TTT AAA AAC CAA ACT TTT CTT ATC AGC ATT TAT	990

Cys	Val	Met	Gly	Ser	Phe	Lys	Asn	Gln	Thr	Phe	Leu	Ile	Ser	Ile	Tyr	
			-110					-105					-100			
CAA	GTC	TTA	CAG	GAG	CAT	CAG	CAC	AGA	GAC	TCT	GAC	CTG	TTT	TTG	TTG	1038
Gln	Val	Leu	Gln	Glu	His	Gln	His	Arg	Asp	Ser	Asp	Leu	Phe	Leu	Leu	
		-95					-90					-85				
GAC	ACC	CGT	GTA	GTA	TGG	GCC	TCA	GAA	GAA	GGC	TGG	CTG	GAA	TTT	GAC	1086
Asp	Thr	Arg	Val	Val	Trp	Ala	Ser	Glu	Glu	Gly	Trp	Leu	Glu	Phe	Asp	
	-80					-75					-70					
ATC	ACG	GCC	ACT	AGC	AAT	CTG	TGG	GTT	GTG	ACT	CCA	CAG	CAT	AAC	ATG	1134
Ile	Thr	Ala	Thr	Ser	Asn	Leu	Trp	Val	Val	Thr	Pro	Gln	His	Asn	Met	
-65					-60					-55					-50	
GGG	CTT	CAG	CTG	AGC	GTG	GTG	ACA	AGG	GAT	GGA	GTC	CAC	GTC	CAC	CCC	1182
Gly	Leu	Gln	Leu	Ser	Val	Val	Thr	Arg	Asp	Gly	Val	His	Val	His	Pro	
				-45					-40					-35		
CGA	GCC	GCA	GGC	CTG	GTG	GGC	AGA	GAC	GGC	CCT	TAC	GAT	AAG	CAG	CCC	1230
Arg	Ala	Ala	Gly	Leu	Val	Gly	Arg	Asp	Gly	Pro	Tyr	Asp	Lys	Gln	Pro	
			-30					-25					-20			
TTC	ATG	GTG	GCT	TTC	TTC	AAA	GTG	AGT	GAG	GTC	CAC	GTG	CGC	ACC	ACC	1278
Phe	Met	Val	Ala	Phe	Phe	Lys	Val	Ser	Glu	Val	His	Val	Arg	Thr	Thr	
		-15					-10					-5				
AGG	TCA	GCC	TCC	AGC	CGG	CGC	CGA	CAA	CAG	AGT	CGT	AAT	CGC	TCT	ACC	1326
Arg	Ser	Ala	Ser	Ser	Arg	Arg	Arg	Gln	Gln	Ser	Arg	Asn	Arg	Ser	Thr	
	1				5					10					15	
CAG	TCC	CAG	GAC	GTG	GCG	CGG	GTC	TCC	AGT	GCT	TCA	GAT	TAC	AAC	AGC	1374
Gln	Ser	Gln	Asp	Val	Ala	Arg	Val	Ser	Ser	Ala	Ser	Asp	Tyr	Asn	Ser	
				20					25					30		
AGT	GAA	TTG	AAA	ACA	GCC	TGC	AGG	AAG	CAT	GAG	CTG	TAT	GTG	AGT	TTC	1422
Ser	Glu	Leu	Lys	Thr	Ala	Cys	Arg	Lys	His	Glu	Leu	Tyr	Val	Ser	Phe	
			35					40					45			
CAA	GAC	CTG	GGA	TGG	CAG	GAC	TGG	ATC	ATT	GCA	CCC	AAG	GGC	TAT	GCT	1470
Gln	Asp	Leu	Gly	Trp	Gln	Asp	Trp	Ile	Ile	Ala	Pro	Lys	Gly	Tyr	Ala	
		50					55					60				
GCC	AAT	TAC	TGT	GAT	GGA	GAA	TGC	TCC	TTC	CCA	CTC	AAC	GCA	CAC	ATG	1518
Ala	Asn	Tyr	Cys	Asp	Gly	Glu	Cys	Ser	Phe	Pro	Leu	Asn	Ala	His	Met	
	65					70					75					
AAT	GCA	ACC	AAC	CAC	GCG	ATT	GTG	CAG	ACC	TTG	GTT	CAC	CTT	ATG	AAC	1566
Asn	Ala	Thr	Asn	His	Ala	Ile	Val	Gln	Thr	Leu	Val	His	Leu	Met	Asn	
	80				85					90					95	
CCC	GAG	TAT	GTC	CCC	AAA	CCG	TGC	TGT	GCG	CCA	ACT	AAG	CTA	AAT	GCC	1614
Pro	Glu	Tyr	Val	Pro	Lys	Pro	Cys	Cys	Ala	Pro	Thr	Lys	Leu	Asn	Ala	
				100					105					110		
ATC	TCG	GTT	CTT	TAC	TTT	GAT	GAC	AAC	TCC	AAT	GTC	ATT	CTG	AAA	AAA	1662
Ile	Ser	Val	Leu	Tyr	Phe	Asp	Asp	Asn	Ser	Asn	Val	Ile	Leu	Lys	Lys	
			115				120						125			
TAC	AGG	AAT	ATG	GTT	GTA	AGA	GCT	TGT	GGA	TGC	CAC	TA	ACTCGAAA			1708

Tyr Arg Asn Met Val Val Arg Ala Cys Gly Cys His  
 130 135 140

CCAGATGCTG	GGGACACACA	TTCTGCCTTG	GATTCCTAGA	TTACATCTGC	CTTAAAAAAA	1768
CACGGAAGCA	CAGTTGGAGG	TGGGACGATG	AGACTTTGAA	ACTATCTCAT	GCCAGTGCCT	1828
TATTACCCAG	GAAGATTTTA	AAGGACCTCA	TTAATAATTT	GCTCACTTGG	TAAATGACGT	1888
GAGTAGTTGT	TGGTCTGTAG	CAAGCTGAGT	TTGGATGTCT	GTAGCATAAG	GTCTGGTAAC	1948
TGCAGAAACA	TAACCGTGAA	GCTCTTCCTA	CCCTCCTCCC	CCAAAAACCC	ACCAAAATTA	2008
GTTTTAGCTG	TAGATCAAGC	TATTTGGGGT	GTTTGTTAGT	AAATAGGGAA	AATAATCTCA	2068
AAGGAGTTAA	ATGTATTCTT	GGCTAAAGGA	TCAGCTGGTT	CAGTACTGTC	TATCAAAGGT	2128
AGATTTTACA	GAGAACAGAA	ATCGGGGAAG	TGGGGGGAAC	GCCTCTGTTC	AGTTCATTCC	2188
CAGAAGTCCA	CAGGACGCAC	AGCCCAGGCC	ACAGCCAGGG	CTCCACGGGG	CGCCCTTGTC	2248
TCAGTCATTG	CTGTTGTATG	TTCGTGCTGG	AGTTTTGTTG	GTGTGAAAAT	ACACTTATTT	2308
CAGCCAAAAC	ATACCATTTC	TACACCTCAA	TCCTCCATTT	GCTGTACTCT	TTGCTAGTAC	2368
CAAAAGTAGA	CTGATTACAC	TGAGGTGAGG	CTACAAGGGG	TGTGTAACCG	TGTAACACGT	2428
GAAGGCAGTG	CTCACCTCTT	CTTTACCAGA	ACGGTTCTTT	GACCAGCACA	TTAACTTCTG	2488
GA CTGCCGGC	TCTAGTACCT	TTTCAGTAAA	GTGGTTCTCT	GCCTTTTTTAC	TATACAGCAT	2548
ACCACGCCAC	AGGGTTAGAA	CCAACGAAGA	AAATAAAATG	AGGGTGCCCA	GCTTATAAGA	2608
ATGGTGTTAG	GGGGATGAGC	ATGCTGTTTA	TGAACGGAAA	TCATGATTTT	CCTGTAGAAA	2668
GTGAGGCTCA	GATTAAATTT	TAGAATATTT	TCTAAATGTC	TTTTTCACAA	TCATGTGACT	2728
GGGAAGGCAA	TTTCATACTA	AACTGATTAA	ATAATACATT	TATAATCTAC	AACTGTTTGC	2788
ACTTACAGCT	TTTTTTGTAA	ATATAAACTA	TAATTTATTG	TCTATTTTAT	ATCTGTTTTG	2848
CTGTGGCGTT	GGGGGGGGGG	CCGGGCTTTT	GGGGGGGGGG	GTTTGTTTGG	GGGGTGTCGT	2908
GGTGTGGGCG	GGCGG					2923

(2) INFORMATION FOR SEQ ID NO:8:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 513 amino acids
  - (B) TYPE: amino acid
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:8:

Met	Pro	Gly	Leu	Gly	Arg	Arg	Ala	Gln	Trp	Leu	Cys	Trp	Trp	Trp	Gly
-374				-370					-365						-360



Leu Leu Cys Ser Cys Cys Gly Pro Pro Pro Leu Arg Pro Pro Leu Pro  
                     -355                                    -350                                    -345

Ala Ala Ala Ala Ala Ala Ala Gly Gly Gln Leu Leu Gly Asp Gly Gly  
                     -340                                    -335                                    -330

Ser Pro Gly Arg Thr Glu Gln Pro Pro Pro Ser Pro Gln Ser Ser Ser  
                     -325                                    -320                                    -315

Gly Phe Leu Tyr Arg Arg Leu Lys Thr Gln Glu Lys Arg Glu Met Gln  
                     -310                                    -305                                    -300                                    -295

Lys Glu Ile Leu Ser Val Leu Gly Leu Pro His Arg Pro Arg Pro Leu  
                                     -290                                    -285                                    -280

His Gly Leu Gln Gln Pro Gln Pro Pro Ala Leu Arg Gln Gln Glu Glu  
                                     -275                                    -270                                    -265

Gln Gln Gln Gln Gln Gln Leu Pro Arg Gly Glu Pro Pro Pro Gly Arg  
                     -260                                    -255                                    -250

Leu Lys Ser Ala Pro Leu Phe Met Leu Asp Leu Tyr Asn Ala Leu Ser  
                     -245                                    -240                                    -235

Ala Asp Asn Asp Glu Asp Gly Ala Ser Glu Gly Glu Arg Gln Gln Ser  
                     -230                                    -225                                    -220                                    -215

Trp Pro His Glu Ala Ala Ser Ser Ser Gln Arg Arg Gln Pro Pro Pro  
                                     -210                                    -205                                    -200

Gly Ala Ala His Pro Leu Asn Arg Lys Ser Leu Leu Ala Pro Gly Ser  
                     -195                                    -190                                    -185

Gly Ser Gly Gly Ala Ser Pro Leu Thr Ser Ala Gln Asp Ser Ala Phe  
                     -180                                    -175                                    -170

Leu Asn Asp Ala Asp Met Val Met Ser Phe Val Asn Leu Val Glu Tyr  
                     -165                                    -160                                    -155

Asp Lys Glu Phe Ser Pro Arg Gln Arg His His Lys Glu Phe Lys Phe  
                     -150                                    -145                                    -140                                    -135

Asn Leu Ser Gln Ile Pro Glu Gly Glu Val Val Thr Ala Ala Glu Phe  
                                     -130                                    -125                                    -120

Arg Ile Tyr Lys Asp Cys Val Met Gly Ser Phe Lys Asn Gln Thr Phe  
                     -115                                    -110                                    -105

Leu Ile Ser Ile Tyr Gln Val Leu Gln Glu His Gln His Arg Asp Ser  
                     -100                                    -95                                    -90

Asp Leu Phe Leu Leu Asp Thr Arg Val Val Trp Ala Ser Glu Glu Gly  
                     -85                                    -80                                    -75

Trp Leu Glu Phe Asp Ile Thr Ala Thr Ser Asn Leu Trp Val Val Thr  
                     -70                                    -65                                    -60                                    -55

Pro Gln His Asn Met Gly Leu Gln Leu Ser Val Val Thr Arg Asp Gly  
                                     -50                                    -45                                    -40

Val His Val His Pro Arg Ala Ala Gly Leu Val Gly Arg Asp Gly Pro  
                     -35                    -30                    -25  
 Tyr Asp Lys Gln Pro Phe Met Val Ala Phe Phe Lys Val Ser Glu Val  
                     -20                    -15                    -10  
 His Val Arg Thr Thr Arg Ser Ala Ser Ser Arg Arg Arg Gln Gln Ser  
                     -5                                    1                                    5                                    10  
 Arg Asn Arg Ser Thr Gln Ser Gln Asp Val Ala Arg Val Ser Ser Ala  
                                     15                                    20                                    25  
 Ser Asp Tyr Asn Ser Ser Glu Leu Lys Thr Ala Cys Arg Lys His Glu  
                                     30                                    35                                    40  
 Leu Tyr Val Ser Phe Gln Asp Leu Gly Trp Gln Asp Trp Ile Ile Ala  
                     45                                    50                                    55  
 Pro Lys Gly Tyr Ala Ala Asn Tyr Cys Asp Gly Glu Cys Ser Phe Pro  
                     60                                    65                                    70  
 Leu Asn Ala His Met Asn Ala Thr Asn His Ala Ile Val Gln Thr Leu  
                     75                                    80                                    85                                    90  
 Val His Leu Met Asn Pro Glu Tyr Val Pro Lys Pro Cys Cys Ala Pro  
                                     95                                    100                                    105  
 Thr Lys Leu Asn Ala Ile Ser Val Leu Tyr Phe Asp Asp Asn Ser Asn  
                     110                                    115                                    120  
 Val Ile Leu Lys Lys Tyr Arg Asn Met Val Val Arg Ala Cys Gly Cys  
                     125                                    130                                    135  
 His

(2) INFORMATION FOR SEQ ID NO:9:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2153 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

(iii) HYPOTHETICAL: NO

(vi) ORIGINAL SOURCE:

- (A) ORGANISM: Homo sapiens
- (H) CELL LINE: U2-OS osteosarcoma

(vii) IMMEDIATE SOURCE:

- (A) LIBRARY: U2-OS human osteosarcoma cDNA library
- (B) CLONE: U2-16

(viii) POSITION IN GENOME:

- (C) UNITS: bp

(ix) FEATURE:

- (A) NAME/KEY: CDS

(B) LOCATION: 699..2063

(ix) FEATURE:

(A) NAME/KEY: mat\_peptide

(B) LOCATION: 1647..2060

(ix) FEATURE:

(A) NAME/KEY: mRNA

(B) LOCATION: 1..2153

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:9:

CTGGTATATT TGTGCCTGCT GGAGGTGGAA TTAACAGTAA GAAGGAGAAA GGGATTGAAT	60
GGACTTACAG GAAGGATTTC AAGTAAATTC AGGGAAACAC ATTTACTTGA ATAGTACAAC	120
CTAGAGTATT ATTTTACACT AAGACGACAC AAAAGATGTT AAAGTTATCA CCAAGCTGCC	180
GGACAGATAT ATATTCCAAC ACCAAGGTGC AGATCAGCAT AGATCTGTGA TTCAGAAATC	240
AGGATTTGTT TTGGAAAGAG CTCAAGGGTT GAGAAGAACT CAAAAGCAAG TGAAGATTAC	300
TTTGGGAACT ACAGTTTATC AGAAGATCAA CTTTGTCTAA TTCAAATACC AAAGGCCTGA	360
TTATCATAAA TTCATATAGG AATGCATAGG TCATCTGATC AAATAATATT AGCCGTCTTC	420
TGCTACATCA ATGCAGCAAA AACTCTTAAC AACTGTGGAT AATTGGAAAT CTGAGTTTCA	480
GCTTTCTTAG AAATAACTAC TCTTGACATA TTCCAAAATA TTTAAAATAG GACAGGAAAA	540
TCGGTGAGGA TGTTGTGCTC AGAAATGTCA CTGTCATGAA AAATAGGTAA ATTTGTTTTT	600
TCAGCTACTG GGAAACTGTA CCTCCTAGAA CCTTAGGTTT TTTTTTTTTT AAGAGGACAA	660
GAAGGACTAA AAATATCAAC TTTTGCTTTT GGACAAAA ATG CAT CTG ACT GTA	713
Met His Leu Thr Val	
-316-315	
TTT TTA CTT AAG GGT ATT GTG GGT TTC CTC TGG AGC TGC TGG GTT CTA	761
Phe Leu Leu Lys Gly Ile Val Gly Phe Leu Trp Ser Cys Trp Val Leu	
-310 -305 -300	
GTG GGT TAT GCA AAA GGA GGT TTG GGA GAC AAT CAT GTT CAC TCC AGT	809
Val Gly Tyr Ala Lys Gly Gly Leu Gly Asp Asn His Val His Ser Ser	
-295 -290 -285 -280	
TTT ATT TAT AGA AGA CTA CGG AAC CAC GAA AGA CGG GAA ATA CAA AGG	857
Phe Ile Tyr Arg Arg Leu Arg Asn His Glu Arg Arg Glu Ile Gln Arg	
-275 -270 -265	
GAA ATT CTC TCT ATC TTG GGT TTG CCT CAC AGA CCC AGA CCA TTT TCA	905
Glu Ile Leu Ser Ile Leu Gly Leu Pro His Arg Pro Arg Pro Phe Ser	
-260 -255 -250	
CCT GGA AAA ATG ACC AAT CAA GCG TCC TCT GCA CCT CTC TTT ATG CTG	953
Pro Gly Lys Met Thr Asn Gln Ala Ser Ser Ala Pro Leu Phe Met Leu	
-245 -240 -235	
GAT CTC TAC AAT GCC GAA GAA AAT CCT GAA GAG TCG GAG TAC TCA GTA	1001

Asp	Leu	Tyr	Asn	Ala	Glu	Glu	Asn	Pro	Glu	Glu	Ser	Glu	Tyr	Ser	Val		
-230						-225					-220						
AGG	GCA	TCC	TTG	GCA	GAA	GAG	ACC	AGA	GGG	GCA	AGA	AAG	GGA	TAC	CCA	1049	
Arg	Ala	Ser	Leu	Ala	Glu	Glu	Thr	Arg	Gly	Ala	Arg	Lys	Gly	Tyr	Pro		
-215					-210					-205					-200		
GCC	TCT	CCC	AAT	GGG	TAT	CCT	CGT	CGC	ATA	CAG	TTA	TCT	CGG	ACG	ACT	1097	
Ala	Ser	Pro	Asn	Gly	Tyr	Pro	Arg	Arg	Ile	Gln	Leu	Ser	Arg	Thr	Thr		
				-195					-190					-185			
CCT	CTG	ACC	ACC	CAG	AGT	CCT	CCT	CTA	GCC	AGC	CTC	CAT	GAT	ACC	AAC	1145	
Pro	Leu	Thr	Thr	Gln	Ser	Pro	Pro	Leu	Ala	Ser	Leu	His	Asp	Thr	Asn		
			-180					-175					-170				
TTT	CTG	AAT	GAT	GCT	GAC	ATG	GTC	ATG	AGC	TTT	GTC	AAC	TTA	GTT	GAA	1193	
Phe	Leu	Asn	Asp	Ala	Asp	Met	Val	Met	Ser	Phe	Val	Asn	Leu	Val	Glu		
		-165				-160						-155					
AGA	GAC	AAG	GAT	TTT	TCT	CAC	CAG	CGA	AGG	CAT	TAC	AAA	GAA	TTT	CGA	1241	
Arg	Asp	Lys	Asp	Phe	Ser	His	Gln	Arg	Arg	His	Tyr	Lys	Glu	Phe	Arg		
	-150					-145					-140						
TTT	GAT	CTT	ACC	CAA	ATT	CCT	CAT	GGA	GAG	GCA	GTG	ACA	GCA	GCT	GAA	1289	
Phe	Asp	Leu	Thr	Gln	Ile	Pro	His	Gly	Glu	Ala	Val	Thr	Ala	Ala	Glu		
-135					-130					-125					-120		
TTC	CGG	ATA	TAC	AAG	GAC	CGG	AGC	AAC	AAC	CGA	TTT	GAA	AAT	GAA	ACA	1337	
Phe	Arg	Ile	Tyr	Lys	Asp	Arg	Ser	Asn	Asn	Arg	Phe	Glu	Asn	Glu	Thr		
				-115					-110					-105			
ATT	AAG	ATT	AGC	ATA	TAT	CAA	ATC	ATC	AAG	GAA	TAC	ACA	AAT	AGG	GAT	1385	
Ile	Lys	Ile	Ser	Ile	Tyr	Gln	Ile	Ile	Lys	Glu	Tyr	Thr	Asn	Arg	Asp		
			-100					-95					-90				
GCA	GAT	CTG	TTC	TTG	TTA	GAC	ACA	AGA	AAG	GCC	CAA	GCT	TTA	GAT	GTG	1433	
Ala	Asp	Leu	Phe	Leu	Leu	Asp	Thr	Arg	Lys	Ala	Gln	Ala	Leu	Asp	Val		
		-85				-80						-75					
GGT	TGG	CTT	GTC	TTT	GAT	ATC	ACT	GTG	ACC	AGC	AAT	CAT	TGG	GTG	ATT	1481	
Gly	Trp	Leu	Val	Phe	Asp	Ile	Thr	Val	Thr	Ser	Asn	His	Trp	Val	Ile		
	-70					-65				-60							
AAT	CCC	CAG	AAT	AAT	TTG	GGC	TTA	CAG	CTC	TGT	GCA	GAA	ACA	GGG	GAT	1529	
Asn	Pro	Gln	Asn	Asn	Leu	Gly	Leu	Gln	Leu	Cys	Ala	Glu	Thr	Gly	Asp		
-55				-50						-45					-40		
GGA	CGC	AGT	ATC	AAC	GTA	AAA	TCT	GCT	GGT	CTT	GTG	GGA	AGA	CAG	GGA	1577	
Gly	Arg	Ser	Ile	Asn	Val	Lys	Ser	Ala	Gly	Leu	Val	Gly	Arg	Gln	Gly		
				-35					-30					-25			
CCT	CAG	TCA	AAA	CAA	CCA	TTC	ATG	GTG	GCC	TTC	TTC	AAG	GCG	AGT	GAG	1625	
Pro	Gln	Ser	Lys	Gln	Pro	Phe	Met	Val	Ala	Phe	Phe	Lys	Ala	Ser	Glu		
			-20					-15					-10				
GTA	CTT	CTT	CGA	TCC	GTG	AGA	GCA	GCC	AAC	AAA	CGA	AAA	AAT	CAA	AAC	1673	
Val	Leu	Leu	Arg	Ser	Val	Arg	Ala	Ala	Asn	Lys	Arg	Lys	Asn	Gln	Asn		
		-5					1				5						
CGC	AAT	AAA	TCC	AGC	TCT	CAT	CAG	GAC	TCC	TCC	AGA	ATG	TCC	AGT	GTT	1721	

Arg	Asn	Lys	Ser	Ser	Ser	His	Gln	Asp	Ser	Ser	Arg	Met	Ser	Ser	Val		
10						15				20					25		
GGA	GAT	TAT	AAC	ACA	AGT	GAG	CAA	AAA	CAA	GCC	TGT	AAG	AAG	CAC	GAA	1769	
Gly	Asp	Tyr	Asn	Thr	Ser	Glu	Gln	Lys	Gln	Ala	Cys	Lys	Lys	His	Glu		
				30					35					40			
CTC	TAT	GTG	AGC	TTC	CGG	GAT	CTG	GGA	TGG	CAG	GAC	TGG	ATT	ATA	GCA	1817	
Leu	Tyr	Val	Ser	Phe	Arg	Asp	Leu	Gly	Trp	Gln	Asp	Trp	Ile	Ile	Ala		
				45				50					55				
CCA	GAA	GGA	TAC	GCT	GCA	TTT	TAT	TGT	GAT	GGA	GAA	TGT	TCT	TTT	CCA	1865	
Pro	Glu	Gly	Tyr	Ala	Ala	Phe	Tyr	Cys	Asp	Gly	Glu	Cys	Ser	Phe	Pro		
		60						65				70					
CTT	AAC	GCC	CAT	ATG	AAT	GCC	ACC	AAC	CAC	GCT	ATA	GTT	CAG	ACT	CTG	1913	
Leu	Asn	Ala	His	Met	Asn	Ala	Thr	Asn	His	Ala	Ile	Val	Gln	Thr	Leu		
	75					80					85						
GTT	CAT	CTG	ATG	TTT	CCT	GAC	CAC	GTA	CCA	AAG	CCT	TGT	TGT	GCT	CCA	1961	
Val	His	Leu	Met	Phe	Pro	Asp	His	Val	Pro	Lys	Pro	Cys	Cys	Ala	Pro		
	90					95				100					105		
ACC	AAA	TTA	AAT	GCC	ATC	TCT	GTT	CTG	TAC	TTT	GAT	GAC	AGC	TCC	AAT	2009	
Thr	Lys	Leu	Asn	Ala	Ile	Ser	Val	Leu	Tyr	Phe	Asp	Asp	Ser	Ser	Asn		
				110					115					120			
GTC	ATT	TTG	AAA	AAA	TAT	AGA	AAT	ATG	GTA	GTA	CGC	TCA	TGT	GGC	TGC	2057	
Val	Ile	Leu	Lys	Lys	Tyr	Arg	Asn	Met	Val	Val	Arg	Ser	Cys	Gly	Cys		
			125					130					135				
CAC	TAATAT	TAAA	TAATATT	GAT	AATAAC	AAAA	AGATCT	GTAT	TAAGG	TTTAT						2110	
His																	
GGCTG	CAATA	AAAAG	CATAC	TTTCAG	ACAA	ACAGAAAA	AAA									2153	

(2) INFORMATION FOR SEQ ID NO:10:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 454 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:10:

Met	His	Leu	Thr	Val	Phe	Leu	Leu	Lys	Gly	Ile	Val	Gly	Phe	Leu	Trp		
-316	-315					-310						-305					
Ser	Cys	Trp	Val	Leu	Val	Gly	Tyr	Ala	Lys	Gly	Gly	Leu	Gly	Asp	Asn	-285	
-300				-295						-290							
His	Val	His	Ser	Ser	Phe	Ile	Tyr	Arg	Arg	Leu	Arg	Asn	His	Glu	Arg		
			-280				-275						-270				
Arg	Glu	Ile	Gln	Arg	Glu	Ile	Leu	Ser	Ile	Leu	Gly	Leu	Pro	His	Arg		
	-265					-260						-255					

Pro Arg Pro Phe Ser Pro Gly Lys Met Thr Asn Gln Ala Ser Ser Ala  
 -250 -245 -240  
 Pro Leu Phe Met Leu Asp Leu Tyr Asn Ala Glu Glu Asn Pro Glu Glu  
 -235 -230 -225  
 Ser Glu Tyr Ser Val Arg Ala Ser Leu Ala Glu Glu Thr Arg Gly Ala  
 -220 -215 -210 -205  
 Arg Lys Gly Tyr Pro Ala Ser Pro Asn Gly Tyr Pro Arg Arg Ile Gln  
 -200 -195 -190  
 Leu Ser Arg Thr Thr Pro Leu Thr Thr Gln Ser Pro Pro Leu Ala Ser  
 -185 -180 -175  
 Leu His Asp Thr Asn Phe Leu Asn Asp Ala Asp Met Val Met Ser Phe  
 -170 -165 -160  
 Val Asn Leu Val Glu Arg Asp Lys Asp Phe Ser His Gln Arg Arg His  
 -155 -150 -145  
 Tyr Lys Glu Phe Arg Phe Asp Leu Thr Gln Ile Pro His Gly Glu Ala  
 -140 -135 -130 -125  
 Val Thr Ala Ala Glu Phe Arg Ile Tyr Lys Asp Arg Ser Asn Asn Arg  
 -120 -115 -110  
 Phe Glu Asn Glu Thr Ile Lys Ile Ser Ile Tyr Gln Ile Ile Lys Glu  
 -105 -100 -95  
 Tyr Thr Asn Arg Asp Ala Asp Leu Phe Leu Leu Asp Thr Arg Lys Ala  
 -90 -85 -80  
 Gln Ala Leu Asp Val Gly Trp Leu Val Phe Asp Ile Thr Val Thr Ser  
 -75 -70 -65  
 Asn His Trp Val Ile Asn Pro Gln Asn Asn Leu Gly Leu Gln Leu Cys  
 -60 -55 -50 -45  
 Ala Glu Thr Gly Asp Gly Arg Ser Ile Asn Val Lys Ser Ala Gly Leu  
 -40 -35 -30  
 Val Gly Arg Gln Gly Pro Gln Ser Lys Gln Pro Phe Met Val Ala Phe  
 -25 -20 -15  
 Phe Lys Ala Ser Glu Val Leu Leu Arg Ser Val Arg Ala Ala Asn Lys  
 -10 -5 1  
 Arg Lys Asn Gln Asn Arg Asn Lys Ser Ser Ser His Gln Asp Ser Ser  
 5 10 15 20  
 Arg Met Ser Ser Val Gly Asp Tyr Asn Thr Ser Glu Gln Lys Gln Ala  
 25 30 35  
 Cys Lys Lys His Glu Leu Tyr Val Ser Phe Arg Asp Leu Gly Trp Gln  
 40 45 50  
 Asp Trp Ile Ile Ala Pro Glu Gly Tyr Ala Ala Phe Tyr Cys Asp Gly  
 55 60 65

Glu Cys Ser Phe Pro Leu Asn Ala His Met Asn Ala Thr Asn His Ala  
     70                            75                            80  
 Ile Val Gln Thr Leu Val His Leu Met Phe Pro Asp His Val Pro Lys  
     85                            90                            95                            100  
 Pro Cys Cys Ala Pro Thr Lys Leu Asn Ala Ile Ser Val Leu Tyr Phe  
                     105                            110                            115  
 Asp Asp Ser Ser Asn Val Ile Leu Lys Lys Tyr Arg Asn Met Val Val  
                     120                            125                            130  
 Arg Ser Cys Gly Cys His  
             135

(2) INFORMATION FOR SEQ ID NO:11:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 1003 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: circular
- (ii) MOLECULE TYPE: cDNA to mRNA
- (iii) HYPOTHETICAL: NO
- (vi) ORIGINAL SOURCE:
  - (A) ORGANISM: Homo sapiens
  - (F) TISSUE TYPE: Human Heart
- (vii) IMMEDIATE SOURCE:
  - (A) LIBRARY: Human heart cDNA library stratagene catalog  
            #936208
  - (B) CLONE: hH38
- (viii) POSITION IN GENOME:
  - (C) UNITS: bp
- (ix) FEATURE:
  - (A) NAME/KEY: CDS
  - (B) LOCATION: 8..850
- (ix) FEATURE:
  - (A) NAME/KEY: mat\_peptide
  - (B) LOCATION: 427..843
- (ix) FEATURE:
  - (A) NAME/KEY: mRNA
  - (B) LOCATION: 1..997
- (xi) SEQUENCE DESCRIPTION: SEQ ID NO:11:

GAATTCC GAG CCC CAT TGG AAG GAG TTC CGC TTT GAC CTG ACC CAG ATC  
     Glu Pro His Trp Lys Glu Phe Arg Phe Asp Leu Thr Gln Ile  
     -139                    -135                            -130

CCG Pro -125	GCT Ala	GGG Gly	GAG Glu	GCG Ala	GTC Val -120	ACA Thr	GCT Ala	GCG Ala	GAG Glu	TTC Phe -115	CGG Arg	ATT Ile	TAC Tyr	AAG Lys	GTG Val -110	97
CCC Pro	AGC Ser	ATC Ile	CAC His -105	CTG Leu -105	CTC Leu	AAC Asn	AGG Arg	ACC Thr	CTC Leu -100	CAC His	GTC Val	AGC Ser	ATG Met	TTC Phe -95	CAG Gln	145
GTG Val	GTC Val	CAG Gln -90	GAG Glu -90	CAG Gln -90	TCC Ser	AAC Asn	AGG Arg	GAG Glu -85	TCT Ser	GAC Asp	TTG Leu	TTC Phe	TTT Phe -80	TTG Leu	GAT Asp	193
CTT Leu	CAG Gln -75	ACG Thr -75	CTC Leu	CGA Arg	GCT Ala	GGA Gly -70	GAC Asp -70	GAG Glu	GGC Gly	TGG Trp	CTG Leu -65	GTG Val -65	CTG Leu	GAT Asp	GTC Val	241
ACA Thr -60	GCA Ala	GCC Ala	AGT Ser	GAC Asp	TGC Cys -55	TGG Trp -55	TTG Leu	CTG Leu	AAG Lys	CGT Arg -50	CAC His -50	AAG Lys	GAC Asp	CTG Leu	GGA Gly	289
CTC Leu -45	CGC Arg	CTC Leu	TAT Tyr	GTG Val -40	GAG Glu -40	ACT Thr	GAG Glu	GAT Asp	GGG Gly	CAC His -35	AGC Ser	GTG Val	GAT Asp	CCT Pro	GGC Gly -30	337
CTG Leu	GCC Ala	GGC Gly	CTG Leu -25	CTG Leu -25	GGT Gly -25	CAA Gln	CGG Arg	GCC Ala -20	CCA Pro -20	CGC Arg	TCC Ser	CAA Gln	CAG Gln -15	CCT Pro -15	TTC Phe	385
GTG Val	GTC Val	ACT Thr -10	TTC Phe -10	TTC Phe	AGG Arg	GCC Ala	AGT Ser	CCG Pro -5	AGT Ser	CCC Pro	ATC Ile	CGC Arg	ACC Thr 1	CCT Pro	CGG Arg	433
GCA Ala	GTG Val 5	AGG Arg	CCA Pro	CTG Leu	AGG Arg 10	AGG Arg 10	AGG Arg	CAG Gln	CCG Pro	AAG Lys 15	AAA Lys 15	AGC Ser	AAC Asn	GAG Glu	CTG Leu	481
CCG Pro 20	CAG Gln	GCC Ala	AAC Asn	CGA Arg 25	CTC Leu 25	CCA Pro	GGG Gly	ATC Ile	TTT Phe	GAT Asp 30	GAC Asp	GTC Val	CAC His	GGC Gly	TCC Ser 35	529
CAC His	GGC Gly	CGG Arg	CAG Gln 40	GTC Val 40	TGC Cys	CGT Arg	CGG Arg	CAC His 45	GAG Glu 45	CTC Leu	TAC Tyr	GTC Val	AGC Ser	TTC Phe 50	CAG Gln	577
GAC Asp	CTT Leu	GGC Gly 55	TGG Trp 55	CTG Leu	GAC Asp	TGG Trp	GTC Val	ATC Ile 60	GCC Ala	CCC Pro	CAA Gln	GGC Gly	TAC Tyr 65	TCA Ser	GCC Ala	625
TAT Tyr	TAC Tyr	TGT Cys 70	GAG Glu 70	GGG Gly	GAG Glu 75	TGC Cys	TCC Ser 75	TTC Phe	CCG Pro	CTG Leu	GAC Asp 80	TCC Ser 80	TGC Cys	ATG Met	AAC Asn	673
GCC Ala 85	ACC Thr 85	AAC Asn	CAC His	GCC Ala	ATC Ile 90	CTG Leu 90	CAG Gln	TCC Ser	CTG Leu	GTG Val	CAC His 95	CTG Leu	ATG Met	AAG Lys	CCA Pro	721
AAC Asn 100	GCA Ala	GTC Val	CCC Pro	AAG Lys 105	GCG Ala 105	TGC Cys	TGT Cys	GCA Ala	CCC Pro	ACC Thr 110	AAG Lys	CTG Leu	AGC Ser	GCC Ala	ACC Thr 115	769



TCT GTG CTC TAC TAT GAC AGC AGC AAC AAC GTC ATC CTG CGC AAG CAC	817
Ser Val Leu Tyr Tyr Asp Ser Ser Asn Asn Val Ile Leu Arg Lys His	
120 125 130	
CGC AAC ATG GTG GTC AAG GCC TGC GGC TGC CAC TGAGTCAGCC CGCCAGCCC	870
Arg Asn Met Val Val Lys Ala Cys Gly Cys His	
135 140	
TACTGCAGCC ACCCTTCTCA TCTGGATCGG GCCCTGCAGA GGCAGAAAAC CCTTAAATGC	930
TGTCACAGCT CAAGCAGGAG TGTCAGGGGC CCTCACTCTC GGTGCCTACT TCCTGTCAGG	990
CTTCTGGGAA TTC	1003

(2) INFORMATION FOR SEQ ID NO:12:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 281 amino acids

(B) TYPE: amino acid

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:12:

Glu Pro His Trp Lys Glu Phe Arg Phe Asp Leu Thr Gln Ile Pro Ala	
-139 -135 -130 -125	
Gly Glu Ala Val Thr Ala Ala Glu Phe Arg Ile Tyr Lys Val Pro Ser	
-120 -115 -110	
Ile His Leu Leu Asn Arg Thr Leu His Val Ser Met Phe Gln Val Val	
-105 -100 -95	
Gln Glu Gln Ser Asn Arg Glu Ser Asp Leu Phe Phe Leu Asp Leu Gln	
-90 -85 -80	
Thr Leu Arg Ala Gly Asp Glu Gly Trp Leu Val Leu Asp Val Thr Ala	
-75 -70 -65 -60	
Ala Ser Asp Cys Trp Leu Leu Lys Arg His Lys Asp Leu Gly Leu Arg	
-55 -50 -45	
Leu Tyr Val Glu Thr Glu Asp Gly His Ser Val Asp Pro Gly Leu Ala	
-40 -35 -30	
Gly Leu Leu Gly Gln Arg Ala Pro Arg Ser Gln Gln Pro Phe Val Val	
-25 -20 -15	
Thr Phe Phe Arg Ala Ser Pro Ser Pro Ile Arg Thr Pro Arg Ala Val	
-10 -5 1 5	
Arg Pro Leu Arg Arg Arg Gln Pro Lys Lys Ser Asn Glu Leu Pro Gln	
10 15 20	
Ala Asn Arg Leu Pro Gly Ile Phe Asp Asp Val His Gly Ser His Gly	
25 30 35	
Arg Gln Val Cys Arg Arg His Glu Leu Tyr Val Ser Phe Gln Asp Leu	

40	45	50
Gly Trp Leu Asp Trp Val Ile Ala Pro Gln Gly Tyr Ser Ala Tyr Tyr		
55	60	65
Cys Glu Gly Glu Cys Ser Phe Pro Leu Asp Ser Cys Met Asn Ala Thr		
70	75	80
Asn His Ala Ile Leu Gln Ser Leu Val His Leu Met Lys Pro Asn Ala		
90	95	100
Val Pro Lys Ala Cys Cys Ala Pro Thr Lys Leu Ser Ala Thr Ser Val		
105	110	115
Leu Tyr Tyr Asp Ser Ser Asn Asn Val Ile Leu Arg Lys His Arg Asn		
120	125	130
Met Val Val Lys Ala Cys Gly Cys His		
135	140	

(2) INFORMATION FOR SEQ ID NO:13:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 3623 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(vii) IMMEDIATE SOURCE:

- (B) CLONE: pALBP2-781

(ix) FEATURE:

- (A) NAME/KEY: CDS
- (B) LOCATION: 2724..3071

(ix) FEATURE:

- (A) NAME/KEY: terminator
- (B) LOCATION: 3150..3218

(ix) FEATURE:

- (A) NAME/KEY: RBS
- (B) LOCATION: 2222..2723

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:13:

GACGAAAGGG CCTCGTGATA CGCCTATTTT TATAGGTAA TGTCATGATA ATAATGGTTT	60
CTTAGACGTC AGGTGGCACT TTTCGGGGAA ATGTGCGCGG AACCCCTATT TGTTTATTTT	120
TCTAAATACA TTCAAATATG TATCCGCTCA TGAGACAATA ACCCTGATAA ATGCTTCAAT	180
AATATTGAAA AAGGAAGAGT ATGAGTATTC AACATTTCCG TGTCGCCCTT ATTCCCTTTT	240
TTGCGGCATT TTGCCTTCCT GTTTTTGCTC ACCCAGAAAC GCTGGTGAAA GTAAAAGATG	300
CTGAAGATCA GTTGGGTGCA CGAGTGGGTT ACATCGAACT GGATCTCAAC AGCGGTAAGA	360

TCCTTGAGAG	TTTTCGCCCC	GAAGAACGTT	TTCCAATGAT	GAGCACTTTT	AAAGTTCTGC	420
TATGTGGCGC	GGTATTATCC	CGTATTGACG	CCGGGCAAGA	GCAACTCGGT	CGCCGCATAC	480
ACTATTCTCA	GAATGACTTG	GTTGAGTACT	CACCAGTCAC	AGAAAAGCAT	CTTACGGATG	540
GCATGACAGT	AAGAGAATTA	TGCAGTGCTG	CCATAACCAT	GAGTGATAAC	ACTGCGGCCA	600
ACTTACTTCT	GACAACGATC	GGAGGACCGA	AGGAGCTAAC	CGCTTTTTTG	CACAACATGG	660
GGGATCATGT	AACTCGCCTT	GATCGTTGGG	AACCGGAGCT	GAATGAAGCC	ATACCAAACG	720
ACGAGCGTGA	CACCACGATG	CCTGTAGCAA	TGGCAACAAC	GTTGCGCAA	CTATTAAGTG	780
GCGAACTACT	TACTCTAGCT	TCCCGGCAAC	AATTAATAGA	CTGGATGGAG	GCGGATAAAG	840
TTGCAGGACC	ACTTCTGCGC	TCGGCCCTTC	CGGCTGGCTG	GTTTATTGCT	GATAAATCTG	900
GAGCCGGTGA	GCGTGGGTCT	CGCGGTATCA	TTGCAGCACT	GGGGCCAGAT	GGTAAGCCCT	960
CCCGTATCGT	AGTTATCTAC	ACGACGGGGA	GTCAGGCAAC	TATGGATGAA	CGAAATAGAC	1020
AGATCGCTGA	GATAGGTGCC	TCACTGATTA	AGCATTGGTA	ACTGTCAGAC	CAAGTTTACT	1080
CATATATACT	TTAGATTGAT	TTAAAACTTC	ATTTTTAATT	TAAAAGGATC	TAGGTGAAGA	1140
TCCTTTTTGA	TAATCTCATG	ACCAAAATCC	CTTAACGTGA	GTTTTCGTTT	CACTGAGCGT	1200
CAGACCCCGT	AGAAAAGATC	AAAGGATCTT	CTTGAGATCC	TTTTTTTCTG	CGCGTAATCT	1260
GCTGCTTGCA	AACAAAAAAA	CCACCGCTAC	CAGCGGTGGT	TTGTTTGCCG	GATCAAGAGC	1320
TACCAACTCT	TTTTCCGAAG	GTAAGTGGCT	TCAGCAGAGC	GCAGATACCA	AATACTGTCC	1380
TTCTAGTGTA	GCCGTAGTTA	GGCCACCACT	TCAAGAACTC	TGTAGCACCG	CCTACATACC	1440
TCGCTCTGCT	AATCCTGTTA	CCAGTGGCTG	CTGCCAGTGG	CGATAAGTCG	TGTCTTACCG	1500
GGTTGGACTC	AAGACGATAG	TTACCGGATA	AGGCGCAGCG	GTCGGGCTGA	ACGGGGGGTT	1560
CGTGACACAC	GCCCAGCTTG	GAGCGAACGA	CCTACACCGA	ACTGAGATAC	CTACAGCGTG	1620
AGCATTGAGA	AAGCGCCACG	CTTCCCGAAG	GGAGAAAGGC	GGACAGGTAT	CCGGTAAGCG	1680
GCAGGGTCGG	AACAGGAGAG	CGCAGGAGGG	AGCTTCCAGG	GGGAAACGCC	TGGTATCTTT	1740
ATAGTCCTGT	CGGGTTTCGC	CACCTCTGAC	TTGAGCGTCG	ATTTTTGTGA	TGCTCGTCAG	1800
GGGGGCGGAG	CCTATGGAAA	AACGCCAGCA	ACGCGGCCTT	TTACGGTTC	CTGGCCTTTT	1860
GCTGGCCTTT	TGCTCACATG	TTCTTTCCTG	CGTTATCCCC	TGATTCTGTG	GATAACCGTA	1920
TTACCGCCTT	TGAGTGAGCT	GATACCGCTC	GCCGCAGCCG	AACGACCGAG	CGCAGCGAGT	1980
CAGTGAGCGA	GGAAGCGGAA	GAGCGCCCAA	TACGCAAACC	GCCTCTCCCC	GCGCGTTGGC	2040
CGATTCATTA	ATGCAGAATT	GATCTCTCAC	CTACCAAACA	ATGCCCCCCT	GCAAAAATA	2100
AATTCATATA	AAAAACATAC	AGATAACCAT	CTGCGGTGAT	AAATTATCTC	TGGCGGTGTT	2160

GACATAAATA CCACTGGCGG TGATACTGAG CACATCAGCA GGACGCACTG ACCACCATGA	2220
AGGTGACGCT CTTAAAAATT AAGCCCTGAA GAAGGGCAGC ATTCAAAGCA GAAGGCTTTG	2280
GGGTGTGTGA TACGAAACGA AGCATTGGCC GTAAGTGCGA TTCCGGATTA GCTGCCAATG	2340
TGCCAATCGC GGGGGGTTTT CGTTCAGGAC TACAACCTGCC ACACACCACC AAAGCTAACT	2400
GACAGGAGAA TCCAGATGGA TGCACAAACA CGCCGCCGCG AACGTCGCGC AGAGAAACAG	2460
GCTCAATGGA AAGCAGCAAA TCCCCTGTTG GTTGGGGTAA GCGCAAAACC AGTTCCGAAA	2520
GATTTTTTTTA ACTATAAACG CTGATGGAAG CGTTTATGCG GAAGAGGTAA AGCCCTTCCC	2580
GAGTAACAAA AAAACAACAG CATAAATAAC CCCGCTCTTA CACATTCCAG CCCTGAAAAA	2640
GGGCATCAAA TTAAACCACA CCTATGGTGT ATGCATTTAT TTGCATACAT TCAATCAATT	2700
GTTATCTAAG GAAATACTTA CAT ATG CAA GCT AAA CAT AAA CAA CGT AAA	2750
Met Gln Ala Lys His Lys Gln Arg Lys	
1 5	
CGT CTG AAA TCT AGC TGT AAG AGA CAC CCT TTG TAC GTG GAC TTC AGT	2798
Arg Leu Lys Ser Ser Cys Lys Arg His Pro Leu Tyr Val Asp Phe Ser	
10 15 20 25	
GAC GTG GGG TGG AAT GAC TGG ATT GTG GCT CCC CCG GGG TAT CAC GCC	2846
Asp Val Gly Trp Asn Asp Trp Ile Val Ala Pro Pro Gly Tyr His Ala	
30 35 40	
TTT TAC TGC CAC GGA GAA TGC CCT TTT CCT CTG GCT GAT CAT CTG AAC	2894
Phe Tyr Cys His Gly Glu Cys Pro Phe Pro Leu Ala Asp His Leu Asn	
45 50 55	
TCC ACT AAT CAT GCC ATT GTT CAG ACG TTG GTC AAC TCT GTT AAC TCT	2942
Ser Thr Asn His Ala Ile Val Gln Thr Leu Val Asn Ser Val Asn Ser	
60 65 70	
AAG ATT CCT AAG GCA TGC TGT GTC CCG ACA GAA CTC AGT GCT ATC TCG	2990
Lys Ile Pro Lys Ala Cys Cys Val Pro Thr Glu Leu Ser Ala Ile Ser	
75 80 85	
ATG CTG TAC CTT GAC GAG AAT GAA AAG GTT GTA TTA AAG AAC TAT CAG	3038
Met Leu Tyr Leu Asp Glu Asn Glu Lys Val Val Leu Lys Asn Tyr Gln	
90 95 100 105	
GAC ATG GTT GTG GAG GGT TGT GGG TGT CGC TAGTACAGCA AAATTAAATA	3088
Asp Met Val Val Glu Gly Cys Gly Cys Arg	
110 115	
CATAAATATA TATATATATA TATATTTTAG AAAAAAGAAA AAAATCTAGA GTCGACCTGC	3148
AGTAATCGTA CAGGGTAGTA CAAATAAAAA AGGCACGTCA GATGACGTGC CTTTTTCTT	3208
GTGAGCAGTA AGCTTGGCAC TGGCCGTCGT TTTACAACGT CGTGACTGGG AAAACCCTGG	3268
CGTTACCCAA CTTAATCGC C TTGCAGCACA TCCCCCTTTC GCCAGCTGGC GTAATAGCGA	3328
AGAGGCCCGC ACCGATCGCC CTTCCCAACA GTTGCGCAGC CTGAATGGCG AATGGCGCCT	3388

GATGCGGTAT TTTCTCCTTA CGCATCTGTG CGGTATTTCA CACCGCATAT ATGGTGCACT	3448
CTCAGTACAA TCTGCTCTGA TGCCGCATAG TTAAGCCAGC CCCGACACCC GCCAACACCC	3508
GCTGACGCGC CCTGACGGGC TTGTCTGCTC CCGGCATCCG CTTACAGACA AGCTGTGACC	3568
GTCTCCGGGA GCTGCATGTG TCAGAGGTTT TCACCGTCAT CACCGAAACG CGCGA	3623

(2) INFORMATION FOR SEQ ID NO:14:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 115 amino acids
  - (B) TYPE: amino acid
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:14:

Met	Gln	Ala	Lys	His	Lys	Gln	Arg	Lys	Arg	Leu	Lys	Ser	Ser	Cys	Lys	1	5	10	15
Arg	His	Pro	Leu	Tyr	Val	Asp	Phe	Ser	Asp	Val	Gly	Trp	Asn	Asp	Trp	20	25	30	
Ile	Val	Ala	Pro	Pro	Gly	Tyr	His	Ala	Phe	Tyr	Cys	His	Gly	Glu	Cys	35	40	45	
Pro	Phe	Pro	Leu	Ala	Asp	His	Leu	Asn	Ser	Thr	Asn	His	Ala	Ile	Val	50	55	60	
Gln	Thr	Leu	Val	Asn	Ser	Val	Asn	Ser	Lys	Ile	Pro	Lys	Ala	Cys	Cys	65	70	75	80
Val	Pro	Thr	Glu	Leu	Ser	Ala	Ile	Ser	Met	Leu	Tyr	Leu	Asp	Glu	Asn	85	90	95	
Glu	Lys	Val	Val	Leu	Lys	Asn	Tyr	Gln	Asp	Met	Val	Val	Glu	Gly	Cys	100	105	110	
Gly	Cys	Arg														115			

(2) INFORMATION FOR SEQ ID NO:15:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 14 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:15:

CATGGGCAGC TGAG

14

(2) INFORMATION FOR SEQ ID NO:16:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 41 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:16:

GAGGGTTGTG GGTGTCGCTA GTGAGTCGAC TACAGCAAAT T

41

(2) INFORMATION FOR SEQ ID NO:17:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 38 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:17:

GGATGTGGGT GCCGCTGACT CTAGAGTCGA CGGAATTC

38

(2) INFORMATION FOR SEQ ID NO:18:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 31 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:18:

AATTCACCAT GATTCCTGGT AACCGAATGC T

31

(2) INFORMATION FOR SEQ ID NO:19:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 25 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:19:  
 GTGGTACTAA GGACCATTGG CTTAC 25

(2) INFORMATION FOR SEQ ID NO:20:

(i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 27 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: single  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:20:  
 CGACCTGCAG CCATGCATCT GACTGTA 27

(2) INFORMATION FOR SEQ ID NO:21:

(i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 27 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: single  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:21:  
 TGCCTGCAGT TTAATATTAG TGGCAGC 27

(2) INFORMATION FOR SEQ ID NO:22:

(i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 15 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: single  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:22:  
 CGACCTGCAG CCACC 15

(2) INFORMATION FOR SEQ ID NO:23:

(i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 81 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:23:

TCGACCCACC ATGCCGGGGC TGGGGCGGAG GGCGCAGTGG CTGTGCTGGT GGTGGGGGCT 60

GTGCTGCAGC TGCTGCGGGC C 81

(2) INFORMATION FOR SEQ ID NO:24:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 73 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:24:

CGCAGCAGCT GCACAGCAGC CCCCACCACC AGCACAGCCA CTGCGCCCTC CGCCCCAGCC 60

CCGGCATGGT GGG 73

(2) INFORMATION FOR SEQ ID NO:25:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 11 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:25:

TCGACTGGTT T 11

(2) INFORMATION FOR SEQ ID NO:26:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 9 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:26:



CGAAACCAG

9

(2) INFORMATION FOR SEQ ID NO:27:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 18 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:27:

TCGACAGGCT CGCCTGCA

18

(2) INFORMATION FOR SEQ ID NO:28:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 10 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:28:

GTCCGAGCGG

10

(2) INFORMATION FOR SEQ ID NO:29:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 29 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:29:

CAGGTCGACC CACCATGCAC GTGCGCTCA

29

(2) INFORMATION FOR SEQ ID NO:30:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 27 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:30:

TCTGTCGACC TCGGAGGAGC TAGTGGC

27